

NOAA
FISHERIES

Improve your scientific writing:
To be read & remembered,
convincing & influential.

Richard S. McBride, Ph.D.
Richard.McBride@noaa.gov

Northeast Fisheries Science Center,
Woods Hole Laboratory

July 18, 2018

1

Dr. Richard S. McBride
Supervisory Research Fishery Biologist
National Marine Fisheries Service
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543 USA

Voice: 508-495-2000 (main desk)

Voice: 508-495-2244 (my office)

Fax: 508-495-2115

email: Richard.McBride@noaa.gov

Learning objectives

Differentiate styles of communication

Compare a writer's versus a reader's perspective of a paper

Apply a 'layers of editing' approach

Identify additional advice you need




You will see this at the end of the talk, too,

So here, I will introduce this as an outline of this talk


Illustration: [forums/science-in-africa/scientific-writing-complex-51396804](https://forums.science-in-africa/scientific-writing-complex-51396804)

Scope of this presentation


Scientific writing




- Providing scientific context (references)
- Text > graphics
- Authorship exclusive
- Focus on results & interpretation



Science communication



- Providing societal context (examples)
- Text ≈ graphics
- Authorship inclusive
- Focus on conclusions & recommendations



Here I thought it would be useful to point out the difference between scientific writing and science communication.

This website's info graphic offers what I thought was a good distinction between these two forms of communication,


and this is certainly a topic that will be explored throughout today's workshop.


Authors write for an unmet reader

Alley (1996) asks:

- Who will read the document?
- What do they know about the subject?
- Why – and how – will they read the document?

“Readers do not simply read; they interpret”
(Gopen and Swan, 1990)



 NOAA FISHERIES

4

There is one main difference between speaking and writing: You cannot track your audience as they read.

Questions asked by Alley, M. (1996). *The Craft of Scientific Writing* (Third Edition). Springer.

Who will read the document?

What do they know about the subject?

Why will they read the document?

How will they read the document?

These questions may or may not be obvious to you, the writer, but at the very least, recognize that: “Readers do not simply read; they interpret”

That means that your words will not magically enter the reader’s brain with the same message that you meant to convey. Misunderstandings are likely to occur because of ambiguity of not only the words used but the general style of the writing. Clear communication happens only after hard work on the writer’s part.

Gopen, G., and J. Swan. 1990. The Science of Scientific Writing. *American Scientist* 78(6):550-558. “we demonstrate a number of rhetorical principles that can produce clarity in communication without oversimplifying scientific issues. The results are substantive, not merely cosmetic: Improving the quality of writing actually improves the quality of thought.”

Illustration by A. Canamucio: <http://www.the-scientist.com/?articles.view/articleNo/19678/title/What-s-Right-About-Scientific-Writing/>

Elements of Scientific Writing



Scavenge your proposal

Establish structure with an outline

How writers write

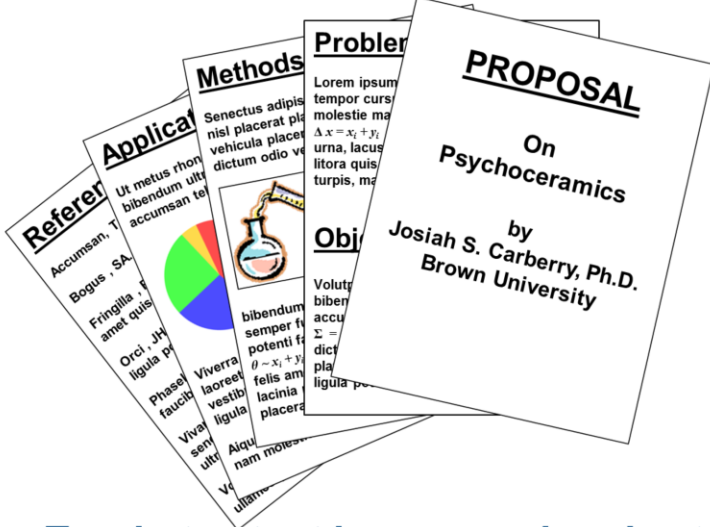
How readers read

The Craft of interpreting Psychological Assessments | Niche Consulting ...

380 x 251 | 48.8KB

www.nicheconsulting.co.nz

Don't forget your proposal



Title

Thesis

Methods

Literature

To what extent have you already started?

NOAA FISHERIES

6

Writing is an integral part of science. Not something you simply tack on at the end of a science project. Your proposal is evidence of that.

How did you get the funding or the motivation to spend so much of your life on your project? You, or someone you work with, had an idea and make a pitch to someone else with deep pockets. Then you got a grant or a contract to support the project.

Or perhaps your advisor has funding, but he asked you to write up a proposal, and you thought it was some administrative hoop to jump through. If you did not put much effort into the proposal, or if you never went back to it, then it was an just a silly hoop, but that is on you isn't it?

Either way, when you begin to start writing, don't reinvent the wheel. Go back to the proposal.

Title (still good?)

Thesis (needs 'thickening'?)

Methods (were/how were these revised?)

Literature reviewed (needs some updating but a good start, right?)

What is known?
What is the limit of (or wrong with) what is known?
How does this new paper go beyond what is known?



Didn't write a proposal?

Well can you at least answer these three questions before you start building a manuscript...?

Doing so will set the stage.

Presumably you can answer these questions from your literature review, but even so,

If you are working with co-authors, this is a good moment to regroup, perhaps exactly as depicted here.

http://www.post-it.com/3M/en_US/post-it/ideas/articles/getting-your-teams-big-ideas-off-the-ground/

Time saver tip: outline then write

Introduction

> 3 paragraphs?

Materials and Methods

Include “Study Area” section?

Skip details and cite other papers?

Results

1. Begin with ‘introductory’ experiment results
2. Report results as you plan to discuss them
3. Save most interesting for last
4. Or, list the most speculative or least solid result last

·
·
·



A three paragraph Introduction?

Perhaps that will follow the three questions posed on the previous slide.

Before you slog through with putting words on paper, look before you leap.

An outline may be essential to divvying up responsibility among co-authors.

There are lots of links out there to help you, as an individual. A sampling:

<http://proeurasiamedwriter.com/Outline/Outline.html>

<http://www.studentgroups.ucla.edu/USJ/guide.pdf>

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178846/>

<https://www.elsevier.com/connect/six-things-to-do-before-writing-your-manuscript>

<https://www.elsevier.com/connect/11-steps-to-structuring-a-science-paper-editors-will-take-seriously>

<http://www.slideshare.net/AmericanJournalExperts/writing-a-cover-letter-for-your-scientific-manuscript>

https://conbio.org/images/content_groups/Africa/Guidelines_ScientificWriting.pdf

https://medschool.vanderbilt.edu/meharry-vanderbilt/files/meharry-vanderbilt/public_files/MVA%20session%202%20and%203_final%2007.10.15.pdf

[http://www.vri.cz/userfiles/file/hide/GRP/How to write a scientific article.pdf](http://www.vri.cz/userfiles/file/hide/GRP/How_to_write_a_scientific_article.pdf)
<http://onlinelibrary.wiley.com/doi/10.1002/bmb.20329/full>
[http://www.aidm-online.com/article/S2351-9797\(14\)00083-8/pdf](http://www.aidm-online.com/article/S2351-9797(14)00083-8/pdf)
<http://ispub.com/IJMH/2/2/13701>

How writers (should) write



Write your methods while they are as fresh as possible.

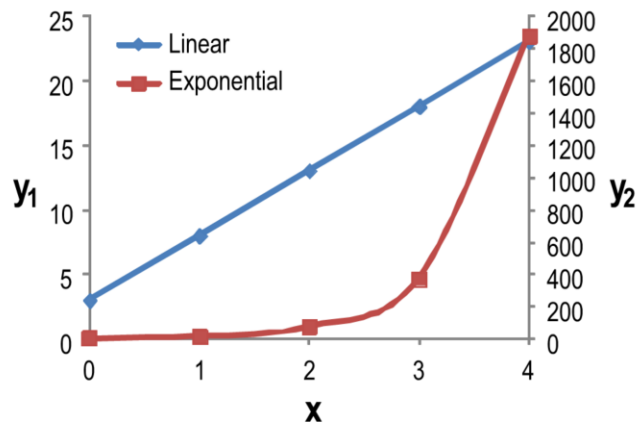
Provide “Enough information ...so that the experiments could be reproduced by a competent colleague.” Day and Gastell (2006).

This may be simple to write by revising material from your proposal with updates from your field or laboratory notes.

Illustration from: <http://people.cornellcollege.edu/bnowakthompson/sciwrite.html>

How writers (should) write

x	y_1	y_2
0	3	3
1	8	15
2	13	75
3	18	375
4	23	1875

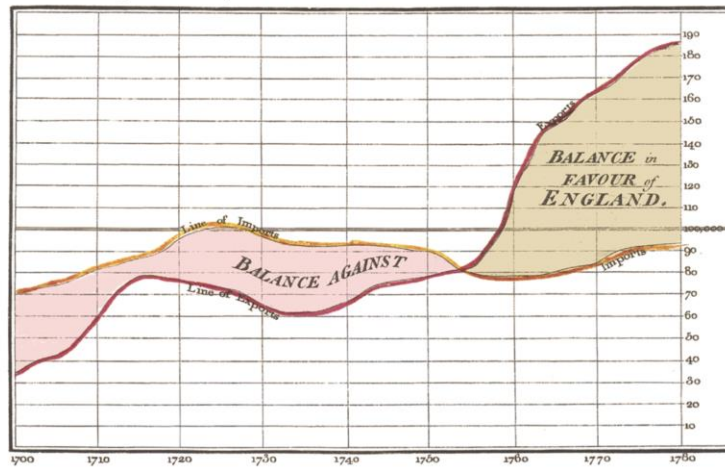


Assemble your illustrations (tables, figures, photos, video) to help you write the results.

The results are probably next, but before you write them, assemble your illustrations so you know what you will write.

Graphic display 'revolutionized' data science

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



The Bottom line is divided into Years, the Right hand line into £10,000 each.
Published at the first time, 1786, by Wm. Playfair. Made single 352, second London.



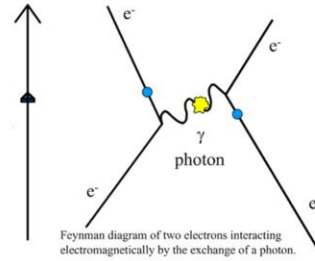
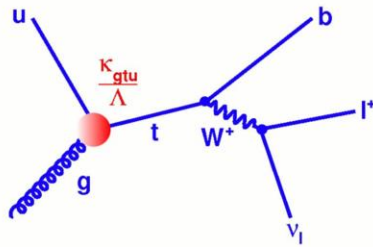
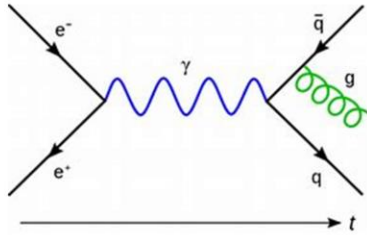
NOAA FISHERIES

Playfair, W. 1786. Commercial and Political Atlas.

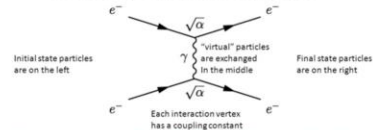
11

https://en.wikipedia.org/wiki/William_Playfair

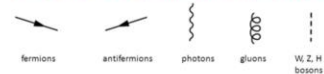
Feynman diagrams



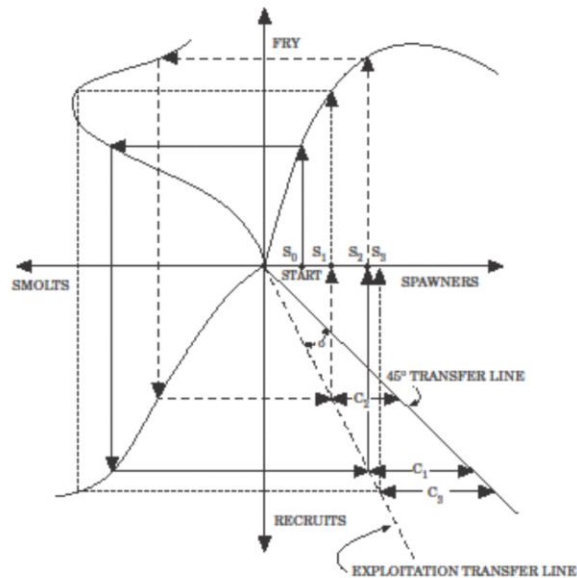
Drawing Feynman Diagrams



Warning – do not interpret diagrams literally as time (x) and space (y) coordinates!



A multi-stage spawner-recruit model (Paulik 1973)



NOAA FISHERIES

Brooks et al. in press. Paulik revisited: Statistical framework and estimation performance of multistage recruitment functions. Fisheries Research.


13


In fisheries, we are often interested in predicting the abundance of fish from one stage to another. This is graphically represented here, and can be modeled with a series of functional equations, as proposed by Gerald J. Paulik.

Figure 194. A multi-stage spawner-recruit relationship for an exploited salmonid stock with three life stages. The ordinate of one life stage becomes the abscissa of the next. A detailed explanation of this figure is given in the text. It may help to rotate the page 90° to the right with reading one life stage to the next. It is assumed the exploitation rate and biological relationships do not change.

Paulik, G. J. (1973). "Studies of the possible form of the stock-recruitment curve." Rapports et Procès-Verbaux des Réunions. Proceedings of a Symposium held in Aarhus 7-10 July 1970 on "Fish Stocks and Recruitment" **164: 302-315.**

How writers (should) write

Introduction		Discussion
<p>Begin broadly, identify problem, define terms, end with a focused thesis statement.</p>		<p>Begin with the most significant finding, put in perspective, consider caveats, end broadly.</p>
<p>Consider to draft these two sections as bookends Then write/revise your title and abstract!</p>		


NOAA FISHERIES
14

“the Discussion and Introduction sections function in an opposite mirrored manner”

[http://www.](http://www.scielo.br/scielo.php?pid=S2179-64912011000400019&script=sci_arttext&tlng=en)

[scielo.br/scielo.php?pid=S2179-64912011000400019&script=sci_arttext&tlng=en](http://www.scielo.br/scielo.php?pid=S2179-64912011000400019&script=sci_arttext&tlng=en)

The introduction should introduce the reader to the general topic and why it is important. I should define jargon or concepts that are necessary to follow the paper, and out map out the outline of the paper.

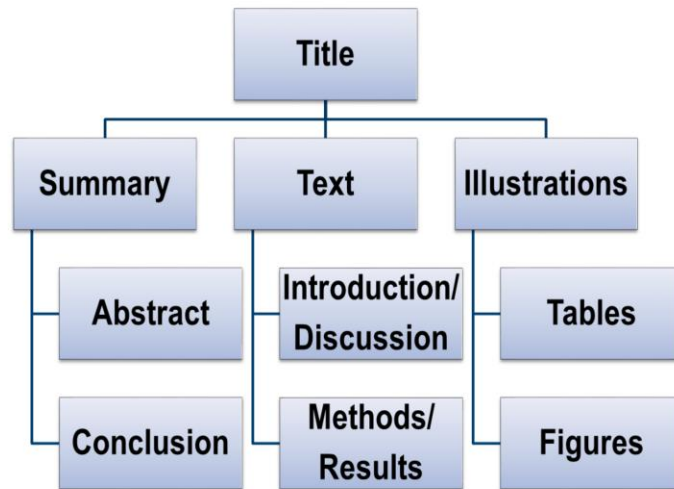
As described by Booth et al., it should finish with a strong claim or thesis statement.

Unless the journal is know for long introductions, or a special section (e.g., study area, historical review) is appropriate, three-four paragraphs are usually sufficient:

- 1) *general nature of the problem and some context (e.g., long-standing, topical, rapidly developing),*
- 2) *specific problem examined in this manuscript*
- 3) *develop the thesis statement (or include as part of the previous paragraph),*
- 4) *how the document is structured.*

The discussion is where the key results can be put in perspective (but not simply repeated, which would be redundant), with some level of speculation is offered along with a hint at what the future.

Readers likely read selectively rather than sequentially

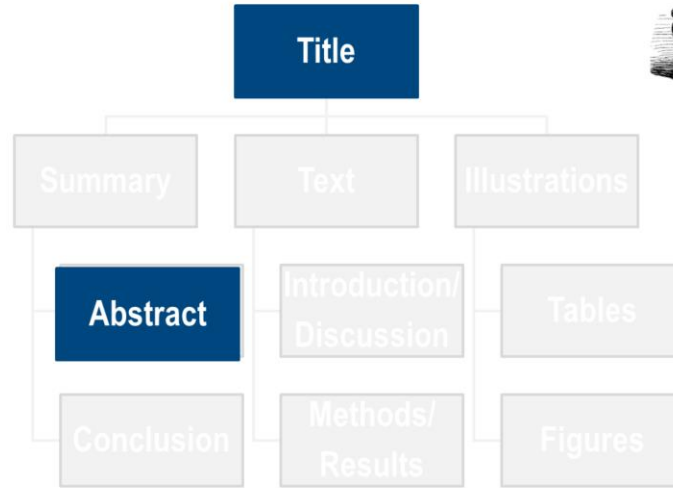


Very, very few people will read the entire paper.

“In conjunction with the master narrative, the modern scientific article has also evolved a master finding system. This system compartmentalizes the essential features in articles through the use of headings and subheadings, tables and figures integrated into the text with numbered captions describing their contents, and citations that supply additional context for statements at any point in the text. **It also permits scientists to read articles selectively rather than sequentially, opportunistically scavenging the various components in search of useful bits of method, theory, and fact.** With headings in place, for example, scientists not interested in methodological details do not need to read the Methods section. Alternatively, with the swarm of data segregated into tables and figures, scientists are able more easily to focus on them or on their commentary in the text or to alternate freely between the two.” (my bold)

<http://www.the-scientist.com/?articles.view/articleNo/19678/title/What-s-Right-About-Scientific-Writing/>

How readers (likely) read



Most people will read only the title of your paper. Make it count.

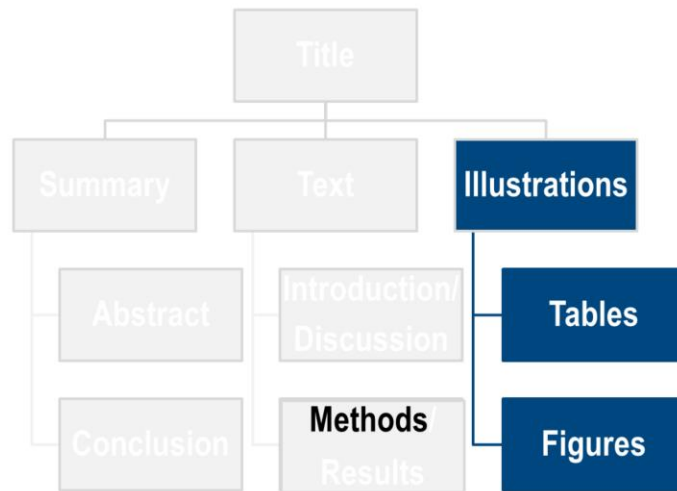
Fewer will also read the abstract.

The abstract should stand alone in providing the context, the specific goal, the major results, and the importance or application of the work.

A particularly hurried reader may only focus on the last 1-2 lines, so if your last line only says 'The results will be discussed,' then they will probably stop there and your work will go uncited as a result.

Image from <http://people.eku.edu/ritchisong/801syl.htm>

How readers (likely) read



Some readers will skim your tables and figures, results or methods...

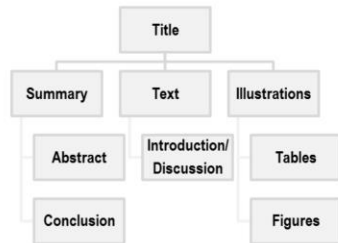
Make sure the legends can stand alone, as the reader may give up if they realize they have to read too much of the text to follow along.

Very few people will read the methods:

Perhaps only the journal reviewers, but also people that take your work so seriously that they will try to replicate it.

If they get to the Discussion, and this section doesn't lead with a powerful summary of the importance of your work, or worse gets off to a slow and uninteresting recapitulation of the results, then there will be fewer people that will read the entire paper.

This format is not only a form of narrative,
it allows readers to find information quickly




Don't get me wrong, I read plenty of papers from beginning to end, and it is a joy to do so with a well written paper that is or has the appearance of a foundational study.

Still, what I just went through is how most papers are treated.

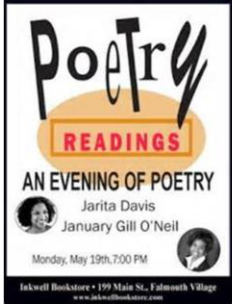
As stated before, in terms of how a scientific paper is written, don't be discouraged in any way that a scientific paper is not read in the way it was written. This stylized, even rigid, format make it easy for a busy professional to find just what they need because they will know where to look for it. Again, work with the readers' expectations!


Jarita Davis' 7 layers of Editing



Dump draft – just get started
Organizing draft – assemble
Spackle draft – fill in gaps
Smoothing draft – paragraph level
Wordsmithing – sentence level
Copy edits – word level
Formatting – author instructions

You can't edit a blank page. - Jodi Picoult




NOAA FISHERIES
19

I like Jarita's recommendation for how to strategically approach writing a manuscript:

This is a strategic approach to revision, revision, and revision:

Dump Draft – Just get started

Organizing – assemble and review what you have, section by section

Spackle draft – fill in gaps

Smoothing draft – paragraph level -- at this point you refine what you have written, as more and more focused layers

Wordsmithing – sentence level

Copy Edits – word level

Formatting – Follow instructions to authors

Here advice provided structure to this excellent advice by Mark Twain:


"The secret of getting ahead is getting started. The secret of getting started is breaking your complex, overwhelming tasks into small, manageable tasks, and then starting on that first one."

Art retrospective example – the masterpieces of 'fine art' started with sketches, studies, mistakes, etc., before the painter sat before a giant canvass.


Too complex? Here is the advice stated without any structure at all (quote by Jodi Picoult)

Jarita Davis: <http://www.nefsc.noaa.gov/publications/contacts.htm>

The big picture



- Anchor everything to a strong claim or hypothesis**
 - Is testable, shows discovery, leads to prediction
- Each section should be coherent**
 - Results in 'Results,' etc.
 - Conclusions ≠ Summary
- Some sections should be coordinated**
 - Title, keywords, & abstract
 - Text & Illustrations
 - Introduction & Discussion
- No surprise endings**



NOAA FISHERIES

20

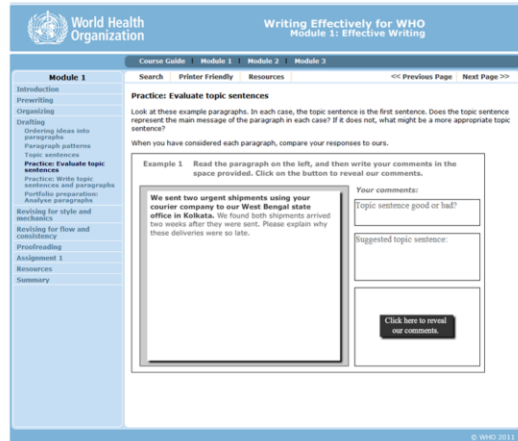
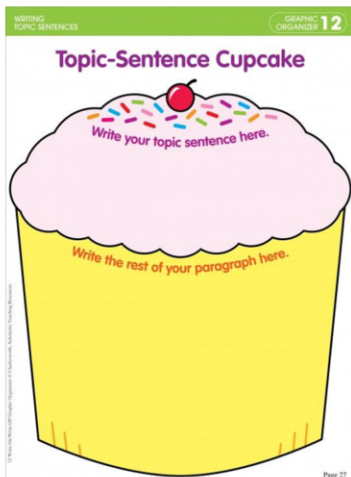
By section: Lack of coherence between sections
 Titles-thesis statement-abstract-text-Illustration
 If not connected, it is a tangent

There are two sides to the 'it is in the text but not in the title, thesis or abstract.' If so, then it is probably a tangent and the text part should be deleted. However, sometimes writers, perhaps unconsciously, have created a 'surprise ending,' a conclusion that simply was not obvious in the abstract. Well, science writing is different than a novel. Remember, your reader has expectations, and 'being surprised or blindsided in the discussion' is not one of those expectations.

Room for some redundancy, but emphasize everything in its proper place
 Put conclusions in the conclusions, summary in the summary, etc.
 Use the correct verb tense in each section

By the illustrations
 Don't repeat the information in a table (or figure) in the text (or visa versa)

Build strong topic sentences: 2 methods



- #9 Make the paragraph the unit of composition: one paragraph to each topic.**
#10 As a rule, begin each paragraph with a topic sentence; end it in conformity with the beginning. (See <http://www.bartleby.com/141/strunk5.html>)



NOAA FISHERIES

<http://colearning.net/who/module1/page35.html>

21

Good topic sentences improve your writing. They satisfy these criteria:

The readability and organization. They usually meet the following criteria:

1. Like the cup cake model (top, right), a topic sentence is the frosting, or more literally the first sentence of the paragraph. If you bury it in a subsequent sentence, or you never really write a topic sentence, then how is a reader to follow the outline of your argument?
2. Topic sentences use keywords or phrases from the thesis or from the outline you presented in the introduction to keep the reader on track.
3. As much as they may introduce the topic of the paragraph, they likely refer back to or transition from the previous paragraph (think of a hamburger [not a cup cake] model, where the buns are the first and last sentences that map out the outline and the meat is in the middle.

Pet peeves:

- Don't start a sentence (or worse the whole paragraph) with 'Table 1 shows the effect of x on y'
- The topic is the phenomenon, not the table (or figure)
- Don't use headers for single paragraphs. That is the job of the topic sentence. Headers should be used to group more than one paragraph together under a common subject (as required by AFS publications).

One thing to try, with a fairly complete draft, is to read just the topic sentences.

Does your argument flow well?

<http://public.wsu.edu/~campbelld/topic.htm>

see also <http://colearning.net/who/module1/page35.html>

<http://printables.scholastic.com/shop/prcontent/Topic-Sentence-Cupcake-Writing-Topic-Sentences-Writing-Skills-Lesson-Plan-Graphic-Organizer/9780545449526-012>

See <http://www.bartleby.com/141/strunk5.html>

#9 Make the paragraph the unit of composition: one paragraph to each topic.

#10 As a rule, begin each paragraph with a topic sentence; end it in conformity with the beginning.

There is a science to scientific writing.

The seven principles of scientific writing

- (1) Place the "new information" you want the reader to emphasize in the *stress position* at the end of the sentence. Save the best for last.
- (2) Place the person or thing whose "story" a sentence is telling at the beginning of the sentence, in the topic position.
- (3) Place "old information" (material already stated) in the topic position, to link reader backwards.
- (4) Follow a subject as soon as possible with its verb.
- (5) Provide context for your reader before asking that reader to consider anything new.
- (6) Articulate the action of every clause or sentence in its verb.
- (7) In general, ensure that the emphasis of the *substance* coincides with the expectations for emphasis raised by the *structure*.
- We have directly measured the enthalpy of hydrogen bond formation between the nucleoside bases 2'-deoxyguanosine (dG) and 2'-deoxycytidine (dC). dG and dC were derivatized at the 5' and 3' hydroxyls with triisopropylsilyl groups; these groups serve both to solubilize the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. Consequently, when the derivatized nucleosides are dissolved in non-aqueous solvents, hydrogen bonds form almost exclusively between the bases. Since the interbase hydrogen bonds are the only bonds to form upon mixing, their enthalpy of formation can be determined directly by measuring the enthalpy of mixing. From our isoperibolic titration measurements, the enthalpy of dG:dC base pair formation is -6.65 ± 0.32 kcal/mol.
- From "The Science of Scientific Writing" by George Gopen and Judith Swan.



NOAA FISHERIES

<http://rebeccaholmes.net/public/img/the-seven-principles-of-scientific-writing.png>

22

<http://www.bartleby.com/141/strunk5.html>

#16 Keep related words together.

<http://rebeccaholmes.net/public/img/the-seven-principles-of-scientific-writing.png>

By sentence: Lack of parallelism

Defined as 'presenting similar information in a similar fashion'

Winter-mortality due to harvesting and other causes was lower in winter than in summer. (http://fisheries.org/docs/pub_stylefl.pdf)

This can also be the case between sentences...

<http://www.bartleby.com/141/strunk5.html>

#14 Avoid a succession of loose sentences.

#15 Express co-ordinate ideas in similar form.

#18 Place the emphatic words of a sentence at the end.

Master the language

Define – or avoid – jargon, slang, or idioms

- Colorful | Confusing

Define or avoid abbreviations & acronyms

- ALL CAPS R HARD 2 READ

Choose terms and stick with them

- “area” is or is not the same as “region”?

**Little things can trip you up.
Use words that work.**

NOAA FISHERIES

23

By words: defining jargon

Overuse of or not defining acronyms or abbreviations

You may not even be aware you are using jargon, slang, or idioms (in an international context)

Abbreviations/acronyms: If not used > 2 times, why use it at all?

By words: Once you have defined the term, please stick with it!

Non-native English speakers don't need to wade through your creative use of synonyms, which will only muddle you point.

The global English style guide : writing clear, translatable documentation for a global market

Author: [John R Kohl](#); [SAS Institute](#). Publisher: Cary, N.C. : SAS Institute, ©2008.

Unnecessary modifiers: Don't tell me that it is 'obvious' in Table 1 or that the result is a 'dramatic' increase. Walk me through the highlights of the table so that it is obvious. Give me a measurable demonstration of the increase (e.g., 2-fold, 2 orders of magnitude?). Remember, show don't tell.

Illustration:

http://www.melissaclarkson.com/teaching/writing_seminar/archived_website/

See <http://www.bartleby.com/141/strunk5.html>

#13 Omit needless words. Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word tell.

Style and Format

A Guide to AFS Publications Style American Fisheries Society 2013

- | | |
|---------------------------------|--|
| 1. Abbreviations and Acronyms | 13. Vendors |
| 2. Capitalization | and Commercial Products |
| 3. Italics | 14. Word Usage |
| 4. Mathematics and Statistics | |
| 5. Numbers and Measurements | |
| 6. Punctuation | |
| 7. Quotations | <u>Appendices</u> |
| 8. References | A. Spelling List |
| 9. Species Names | B. Symbols, Abbreviations,
and Acronyms |
| 10. Spelling and Compound Words | C. Plurals of Fish Names |
| 11. Symbols | D. Geographic and Geological Terms |
| 12. Tables and Figures | |

Boring but important.

Endear yourself to the (copy) editor and follow these.

A more general example

Council, of Science Editors (2014) Scientific Style and Format: The CSE manual for authors, editors, and publishers, Eighth Edition.

<http://press.uchicago.edu/ucp/books/book/chicago/S/bo13231737.html>

Preface

Acknowledgments

Part 1: Publishing Fundamentals

Chapter 1 Elements of a Scientific Publication

Chapter 2 Publication Policies and Practices

Chapter 3 The Basics of Copyright

Part 2: General Style Conventions

Chapter 4 Alphabets, Symbols, and Signs

Chapter 5 Punctuation and Related Marks

Chapter 6 Spelling, Word Formation and Division, Plurals, and Possessives

Chapter 7 Prose Style and Word Choice

Chapter 8 Names and Personal Designations

Chapter 9 Capitalization

Chapter 10 Type Styles, Excerpts, Quotations, and Ellipses

Chapter 11 Abbreviations

Chapter 12 Numbers, Units, Mathematical Expressions, and Statistics

Chapter 13 Time, Dates, and Age Measurements

Chapter 14 Geographic Designations

Part 3: Special Scientific Conventions

Chapter 15 The Electromagnetic Spectrum

Chapter 16 Subatomic Particles, Chemical Elements, and Related Notations

Chapter 17 Chemical Formulas and Names

Chapter 18 Chemical Kinetics and Thermodynamics

Chapter 19 Analytical Chemistry

Chapter 20 Drugs and Pharmacokinetics

Chapter 21 Genes, Chromosomes, and Related Molecules

Chapter 22 Taxonomy and Nomenclature

Chapter 23 Structure and Function

Chapter 24 Disease Names

Chapter 25 The Earth

Chapter 26 Astronomical Objects and Time Systems

Part 4: Technical Elements of Publications

Chapter 27 Journal Style and Format

Chapter 28 Published Media

Chapter 29 References

Chapter 30 Accessories to Text: Tables, Figures, and Indexes

Chapter 31 Typography and Manuscript Preparation

Chapter 32 Proof Correction

Bibliography

Index

Revise, revise, revise

“Vision plays an important role in notifying animals of imminent danger, such as an impending collision with a predator or an environmental surface.”

Appeared in Science (1995), written by 3 Caltech PhDs

Flesch Reading Ease: college graduate level

Fog Scale Level: very difficult

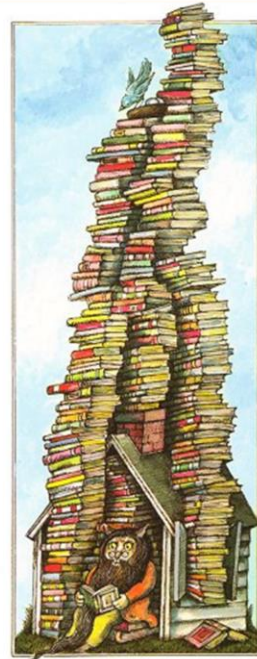
“Without eyes, you'd soon crash into a tiger or a cliff.”

Suggested revision by Nicholas Wade, New York Times

Flesch Reading Ease: plain English

Fog Scale Level: readable

**Science is complex enough,
don't make it more so.**



<http://sarahktyler.com/code/readability.php> 25

A couple-three parting shots

<http://www.nytimes.com/1995/12/10/magazine/method-madness-racing-to-the-top.html>

(which, of course, answers the question of how many Caltech PhDs does it take to write a sentence.)

Image: books to the ceiling, by Arnold Lobel

Don't just take my advice

COLUMN: GUEST DIRECTOR'S LINE

Several Books to Read and Thereby Delay Writing Your Thesis



Before "The Simpsons" appeared on television, Matt Groening produced some offbeat cartoons that I followed in the *Chicago Reader*. In one cartoon, an anthropomorphic rabbit, who was struggling to complete graduate school, arrived at a clever delay tactic: "Read another book!"

At the risk of sounding like Groening's rabbit, about a dozen websites on the communication, and, yes, reading them will

of your own. One chapter promotes the proper usage of the English—and fishery—language using examples of (all too) common writing problems, and another chapter offers advice to assuage the trauma of negative critiques or editorial rejection. The chapter on graphic display of data illustrates 21 different figure types, and 2 chapters introduce the topic of

Richard S. McBride

McBride is a supervisory fishery research biologist for the National Marine Fisheries Service and an associate editor for *Transactions of the American Fisheries Society*. He can be contacted at Richard.McBride@noaa.gov

**There are lots of resources out there.
Use them.**

is an excellent index that is indis-
fer back to the

Writing about
06) covers
the basics of preparing an IMRD



NOAA FISHERIES

Fisheries. 34(2): 80-82.

26

I learned during my graduate school experience that scientists write a lot, and I even had some very good mentors teach me how to write better. Mostly I learned that I liked to write but that I was not very good at it. Don't get me wrong, I write better than average, but at the post-doctoral level I realized that if I was to reach my full potential, I needed to tackle this performance issue head on.

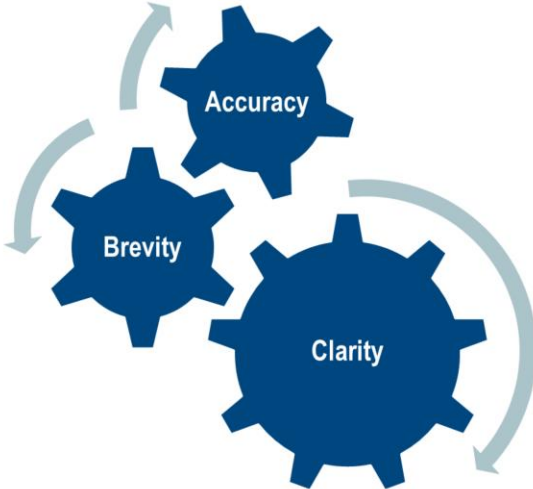
So I read books. Lots of them. Cover to cover.
Show the books you have brought with you.

Then I realized that others might want to do the same thing and that I could help them be selective about which book to read, so I wrote this article in 'Fisheries' in 2009.


My point is that there are some great resources out there, so use them.

McBride, R. S. 2009. Several books to read and thereby delay writing your thesis. *Fisheries* 34(2):80-82. <http://www.daogee.info/pdf/thereby/0.pdf>


Fred Serchuk's ABCs



A diagram showing three interlocking blue gears. The top gear is labeled 'Accuracy', the bottom-left gear is labeled 'Brevity', and the bottom-right gear is labeled 'Clarity'. Grey curved arrows indicate a clockwise flow from Accuracy to Brevity, from Brevity to Clarity, and from Clarity back to Accuracy.



A small portrait of Fred Serchuk, a man with a beard and sunglasses, wearing a blue collared shirt.

 NOAA FISHERIES

fred.serchuk@gmail.com 27

I cannot talk about writing for science without tipping my hat to Fred Serchuck. Dr. Serchuck retired from NMFS last year, but he still communicates with many of us in near daily emails filled with writing tips.

I know that some of you here today attended his seminars on scientific writing, one of which was held in Woods Hole back in 2013 as an AIFRB/AFS-SNEC-sponsored workshop like what is occurring today.

As I recall, Fred could talk a couple-three hours on this topic along, so with a bit of irony, I have pulled these three words from his talk.

I don't think you can find three more informative words to keep in mind if you are writing and revising your work.

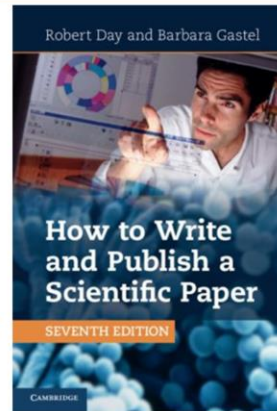
Day & Gastel's "cookbook"

Part II. Preparing the Text

7. How to prepare the title
8. How to list the authors and addresses
9. How to prepare the abstract
10. How to write the introduction
11. How to write the materials and methods section
12. How to write the results
13. How to write the discussion
14. How to state the acknowledgements
15. How to cite the references

Part III. Preparing the Tables and Figures

16. How to design effective tables
17. How to prepare effective graphs
18. How to prepare effective photographs



Day, R. A., and B. Gastel. 2006. How to Write and Publish a Scientific Paper: 6th Edition. Greenwood Press.

“Over the past three centuries, however, a master narrative has evolved. This narrative represents a tribute to the efficacy of the experimental method as a means of exploring nature. It opens with a title and abstract intended to minimize the time and effort needed to uncover the article's gist. That is followed by an introduction placing the reader in the scientific context in which the authors are working. Next comes the main body: a section on methods and materials that outlines the procedures and materials used to acquire new facts, a results section that displays the facts so generated and the intellectual context of their acquisition, and a discussion section that offers an explanation for the new facts. A conclusion section reiterates the central facts and explanations and, perhaps, also addresses future work that would confirm or extend the original investigation. This narrative is not a straitjacket, but a flexible prototype out of which authors fashion numerous variations.

An often-overlooked complement to this verbal narrative is the visual evidence presented in establishing facts and their explanations. Scientific visuals perform multiple tasks. They depict relationships visible in nature, such as those between insects and plants; relationships in nature not visible to the naked eye, such as crystalline structures and underground geological sections; relationships posited by a theory, such as the Feynman diagram; or tables and graphs organizing masses of data in support of lawlike relationships.


Because of their obvious communicative utility, visuals have greatly increased in number and proportion taken up within the text. As a result of this increased visual component, the scientific article has now become almost as much about interpreting information in figures and tables as reading straight text.”


<http://www.the-scientist.com/?articles.view/articleNo/19678/title/What-s-Right-About-Scientific-Writing/>

<http://istl.org/06-summer/review3.html>

Alley's “craft” approach

Structure	<ul style="list-style-type: none"> • Not about the I-M-R-D structure per se • Begin-Middle-End; transitions
Language	<ul style="list-style-type: none"> • Precision, clarity, forth-rightness, familiarity, conciseness, fluidity
Illustrations	<ul style="list-style-type: none"> • How you should build your text from your tables & figures
Readers	<ul style="list-style-type: none"> • How they decode a page, a paragraph, a sentence, a word




29

Interestingly, Alley never talks about the I-M-R-D format

Instead he write more generally. In terms of structure – beginning, middle, end with transitions

In terms of language -- precision, clarity, forth-rightness, familiarity, conciseness, and fluidity

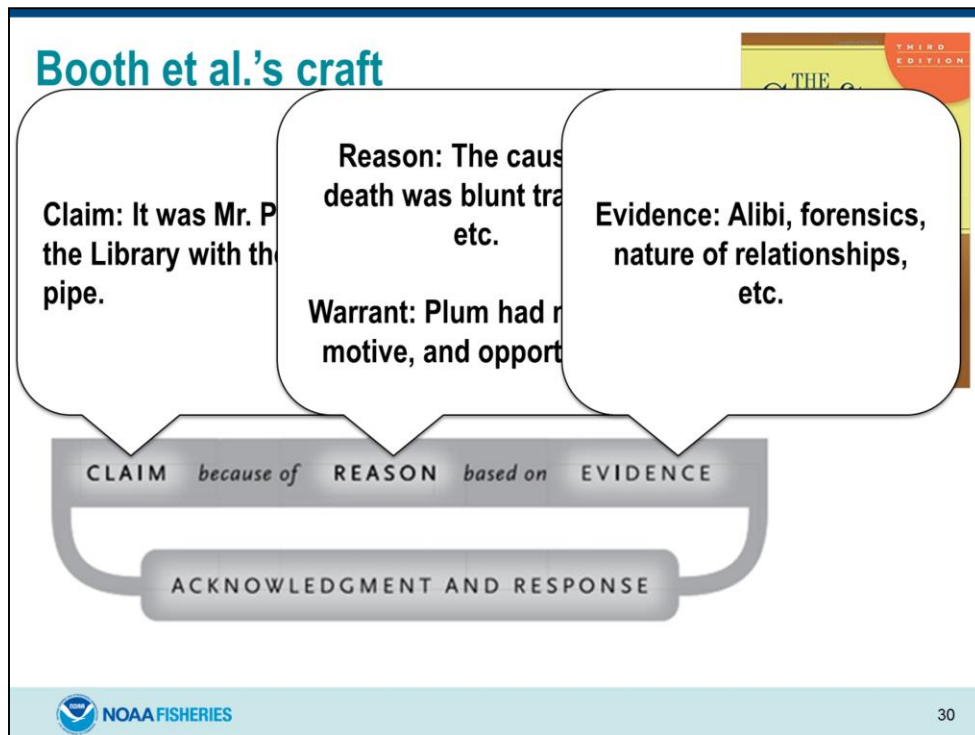
Does the word communicate the needed precision?

If precise, does the word avoid needless complexity?

If precise, does the word avoid being too abstract?

Writing examples are deconstructed to show how to hone this “craft” and to reveal the benefits of revising your own writing (see www.writing.engr.psu.edu/csw.html for a preview.)

e,g, <https://www.softchalkcloud.com/lesson/serve/p0Jh74EBzuWYca/html>



https://docs.google.com/presentation/d/1sw6uY-Lpm_162rUwaSDFqG1PL7za0_c93szqZ0msodY/edit?pli=1#slide=id.g238f4ab0_0_77

Most obvious in the process of science is to advance a 'claim' and support it with 'evidence'. However, you need to 'reason' with reader that the evidence is relevant to claim. Booth et al. also discuss that you will likely need to establish a connection (called the warrant) between the claim and reason.

All of this can get confusing quickly, so as an example, let's use the game of 'Clue'

Finally, science is most robust when a 'family' of hypotheses are considered. This may occur up front, with multiple claims-warrants-reasons-evidence

Or perhaps at the back end, as part of a process of acknowledging and responding to various issues that could affect your logical argument.

See, for example, Chamberlin, T. C. 1965. The method of multiple working hypotheses. Science 148:754-759.

Book reviews of "The Craft of Research" [Marcia B. Baxter Magolda](#), From: [The Review of Higher Education](#), Volume 32, Number 2, Winter 2009 , pp. 284-285 | 10.1353/rhe.0.0055

Illustration from: Febby Ai: Summary Of "The Craft Of Research" 543 x 307 | 47.7KB [fayra-](#)

ai.blogspot.com

http://mason.gmu.edu/~afinn/html/teaching/courses/250_s2002/craftofresearch.pdf

See also: <http://www.sciencemag.org/careers/2016/11/how-keep-scientific-literature>

Learning objectives

Differentiate styles of communication

Compare a writer's versus a reader's perspective of a paper

Apply a 'layers of editing' approach

Identify additional advice you need



NOAA FISHERIES

<http://www.nefsc.noaa.gov/nefsc/woodshole/seminar-public.html> 31

- 1) Whether you are speaking, making a poster, or writing a report, match your approach to the occasion
- 2) Writing a paper sequentially is not necessary nor may it be efficient, and readers are unlikely to read your paper sequentially, either.
- 3) Once you realize that, you are free to build a manuscript in a way that works best. I suggest a 'layers of revision' style.
- 4) Our hour together will hopefully jump start your success at writing your next manuscript, but in the long term, there are lots of resources out there, so take stock of what you think your particular weakness is and work on that in a strategic way.

Illustration: [forums/science-in-africa/scientific-writing-complex-51396804](https://forums.science-in-africa.com/scientific-writing-complex-51396804)

